

REMARKS

Claims 1-7 are herein canceled. Claims 21-27 are newly added; however, no new matter is added and all features recited in the newly added claims 21-27 are fully supported by the specification and drawings, as filed. Therefore claims 8-27 are all the claims pending in the application.

Claims 8-20 stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion.

I. Informality Objections

The disclosure was objected to because of informalities. Claims 9-17 are amended herein to correct the cited informalities. Specifically, the dependent claims were amended to read "method of" rather than "method in".

II. The Prior Art Rejections

Claims 1-20 stand rejected under 35 U.S.C. §102(b) as being anticipated by Tsuchiya, et al. (U.S. Patent No. 5,536,603) hereinafter referred to as Tsuchiya, or Brunner, et al. (U.S. Patent No. 5,470,681) hereinafter referred to as Brunner, or Lee (U.S. Patent No. 5,900,337). Applicants respectfully traverse these rejections based on the following discussion.

A. The Rejection of Claims 1-20 Based on Tsuchiya

While rejecting all pending claims 1-20 as anticipated by the language found in claim 19 of Tsuchiya, the Office Action addresses only the features of independent claim 1 and its dependent claims 2-7. The Office Action does not address the patentable features of claims 8-20.

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Regarding independent claim 8, the Applicants submit that the cited portions of Tsuchiya do not teach or suggest the following features: (1) patterning an etch stop layer on the non-transparent film; (2) patterning the non-transparent film using the etch stop layer ...; (3) polishing the etch stop layer; and (4) removing the etch stop layer. Similarly, regarding independent claim 18, Tsuchiya does not teach or suggest the following features: (1) an etch stop layer above the non-transparent film; and (2) that the phase shift material has a polished top surface above the patterned non-transparent film and comprises a predetermined thickness controlled by a thickness of the etch stop layer.

More particularly, the Office Action cites the language of claim 19 of Tsuchiya as anticipating all of the claimed features of the invention. Generally, the method of forming a phase shift mask taught by Tsuchiya comprises forming a patterned light-shielding film (e.g., a non-transparent film such as chrome) on a transmitting substrate (e.g., quartz) such that portions of the substrate are exposed (see column 6, lines 34-38). A first photo resist pattern (i.e., a mask) is formed on some portions of the substrate such that other portions remain exposed. A first phase shifter is formed on the exposed portions of the substrate. The first photo resist pattern is removed. A second photo resist pattern is formed, again leaving portions of the substrate exposed. Then, a second phase shifter is formed on the exposed portions of the substrate.

Tsuchiya does not, however, teach or suggest the features of patterning an etch stop layer on the light-shielding film and then using the etch stop layer to pattern the light-shielding film. Tsuchiya also does not teach or suggest that after the phase shift oxide material is formed, it is polished down to the etch stop layer. This polishing step enhances the uniformity of the phase shifter thickness (which is necessarily controlled by the thickness of the etch stop layer) and also provides a flat optical surface to the phase shifter (see specification paragraphs [0029-30]). While Tsuchiya discloses "forming a light-shielding film pattern on a transmitting substrate", it does not disclose how the light-shielding film pattern is actually formed. Additionally, while Tsuchiya discloses "controlling ... thicknesses of the first phase shifter and the second phase shifter ...", it only discloses controlling the thicknesses of the phase shifters during the deposition

process (see column 8, lines 26-40).

Therefore, independent claims 8 and 18 are patentable over Tsuchiya. Furthermore, dependent claims 9-17 and 19-20 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

B. The Rejection of Claims 1-20 Based on Brunner

While rejecting all pending claims 1-20 as anticipated by the language found in claims 1, 4 and 5 of Brunner, the Office Action addresses only the features of independent claim 1 and its dependent claims 2-7. The Office Action does not address the patentable features of claims 8-20.

Regarding independent claim 8, the Applicants submit that the cited portions of Brunner do not teach or suggest the following features: (1) patterning an etch stop layer on the non-transparent film; (2) patterning the non-transparent film using the etch stop layer ...; (3) polishing the etch stop layer; and (4) removing the etch stop layer. Similarly, regarding independent claim 18, Brunner does not teach or suggest the following features: (1) an etch stop layer above the non-transparent film; and (2) that the phase shift material has a polished top surface above the patterned non-transparent film and comprises a predetermined thickness controlled by a thickness of the etch stop layer.

More particularly, the Office Action cites the language of claims 1, 4 and 5 of Brunner as anticipating all of the claimed features of the invention. Generally, the method of forming the phase shift mask taught by Brunner comprises beginning with a layered structure comprising a transparent substrate 30, an opaque mask 34, a thick polyimide 36, a nitride layer 38 and a patterned resist layer (see Figure 1A). A pattern of openings is formed through the layers to the substrate (see Figure 1B). The method then

comprises “selectively depositing silica in said openings to a first thickness ...” (see claim 1), “applying a further pattern of material ...”, and “further selectively depositing silica in remaining ones of said openings to a second thickness ...” (see claim 4).

Brunner does not, however, teach or suggest the features of patterning an etch stop layer on the non-transparent layer (i.e., the opaque mask), using the etch stop layer to pattern the non-transparent layer. Nor does Brunner teach or suggest that after the phase shift oxide material (e.g., silica) is formed, it is polished down to the etch stop layer. This polishing step enhances the uniformity of the phase shifter thickness (which is necessarily controlled by the thickness of the etch stop layer) and also provides a flat optical surface to the phase shifter (see specification paragraphs [0029-30]). Contrarily, in Brunner the nitride layer 38 is removed prior to the formation of the phase shift material 44 in each of the holes (see Figure 2). Additionally, as with Tsuchiya discussed above, the thickness of the phase shift material is controlled by the process that is used to deposit the phase shift material. Specifically, the varying thicknesses of the phase shift material 44 in the holes are controlled by putting masks 50 over some holes, depositing the phase shift material 44 to a first thickness, covering some of the holes having phase shift material with masks 50, depositing more phase shift material, etc. (see Figures 2-3). Then, the polyimide is removed (see Figure 4). Consequently, polishing the phase shift material to an etch stop layer (the thickness of which controls the thickness of the phase shift material) so as to provide a phase shifter material with a more uniform thickness and a flat surface is particularly not disclosed.

Therefore, independent claims 8 and 18 are patentable over Brunner. Furthermore, dependent claims 9-17 and 19-20 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

C. The Rejection of Claims 1-20 Based on Lee

While rejecting all pending claims 1-20 as anticipated by the language found in claims 19-21 of Lee, the Office Action addresses only the features of independent claim 1 and its dependent claims 2-7. The Office Action does not address the patentable features of claims 8-20.

Regarding independent claim 8, the Applicants submit that the cited portions of Lee do not teach or suggest the following features: (1) patterning an etch stop layer on the non-transparent film; (2) polishing the etch stop layer; and (3) removing the etch stop layer. Similarly, regarding independent claim 18, Lee does not teach or suggest the following features: (1) an etch stop layer above the non-transparent film; and (2) that the phase shift material has a polished top surface above the patterned non-transparent film and comprises a predetermined thickness controlled by a thickness of the etch stop layer.

More particularly, the Office Action cites the language of claims 19-21 of Lee as anticipating all of the claimed features of the invention. Generally, the method of forming the phase shift mask taught by Lee comprises beginning with a layered substrate comprising a light transmissive (i.e., transparent) substrate 40, an etch stop layer 41 on the substrate 40, a light shielding (i.e., non-transparent) layer 42 on the etch stop layer 41, an oxidation preventing layer 43 on the light shielding layer 42, and a patterned photoresist layer 44 on the light shielding layer 42 (see column 5, lines 43-55 and Figure 5A). Openings 45 are etched to the etch stop layer 41 (see Figure 5C). Exposed portions of the light shielding layer are thermally oxidize (see column 5, lines 59-61 and Figure 5C) so that a first phase shift layer is formed. Additional processes can include masking, etching and masking again (see Figures 5D-E). Then, a second phase shift layer is formed on exposed portions of the etch stop layer and the masks are removed (see Figures 5F-G). The resulting structure is an etch stop layer upon which are different light transmissive patterns (see Abstract).

Lee does not, however, teach or suggest the features of patterning an etch stop layer on the light-shielding film and then using the etch stop layer to pattern the light-shielding film. Lee also does not teach or suggest that after the phase shift oxide material is formed, it is polished down to the etch stop layer. This polishing step enhances the uniformity of the phase shifter thickness (which is necessarily controlled by the thickness of the etch stop layer) and also provides a flat optical surface to the phase shifter (see specification paragraphs [0029-30]). In Lee the etch stop layer 41 is formed between the transparent substrate 40 and the light shielding layer 42, not above the light shielding layer (see Figure 5A). Additionally, as with Tsuchiya and Brunner discussed above, the thickness of the second phase shift layer is controlled by the deposition process that is used to form the layer. Specifically, the second phase shift layer is deposited or sputtered into holes 51 (see Figure 5F) so that it has the same thickness as the first phase shift layer (see column 6, lines 24-36). Consequently, polishing the phase shift material to an etch stop layer (the thickness of which controls the thickness of the phase shift material) so as to provide a phase shifter material with a more uniform thickness and a flat surface is particularly not disclosed.

Therefore, independent claims 8 and 18 are patentable over Lee. Furthermore, dependent claims 9-17 and 19-20 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion


With respect to the objections to the claims, the claims have been amended, above, to overcome these objections. With respect to the rejections to the claims, as discussed above, the Applicants respectfully traverse the rejections.

Specifically, in view of the foregoing remarks, Applicants submit that claims 8-20 and newly added claims 21-27, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Therefore, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims and to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0458.

Respectfully submitted,

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Pamela M. Riley
Registration No. 40,146

Gibb I.P. Law Firm, L.L.C.
2568-A Riva Road, Suite 304
Annapolis, MD 21401
Voice: (410) 573-0227
Fax: (301) 261-8825
Customer Number: 29154